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Bittacus chevalieri (Navás, 1908) (Mecoptera: Bittacidae), newly recorded from Socotra and found to occur in Pakistan and India

by

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ABSTRACT

Bittacus chevalieri (Navás, 1908) is redescribed using new material from Socotra (Yemen) and Mali. New illustrations of the head, wings and genitalia (male and female) are provided. *B. nodosus* Rust & Byers, 1976, from Pakistan and India, is considered to be a synonym. Previous work on the species is reviewed and the extensive distribution, which ranges from Senegal in West Africa to India, is discussed.

INTRODUCTION

This paper was prompted by the recent discovery, in good numbers, of a *Bittacus* species on Socotra. Apart from Rust & Byers' (1976) record of a single *Bittacus* specimen without abdomen from Hadibu, there are no other records of Mecoptera from this island. With the identification of this species as *B. chevalieri* (Navás, 1908), it is now possible to provide a lot more information about this extremely widely distributed afrotropical species.

A brief review of the taxonomic history of *B. chevalieri* follows:

Navás (1908: 15–16) – Described *Haplodictyus chevalieri* on a single female from Kanem (a province of present-day Chad) without providing details concerning the number or gender of specimens studied. The species was placed in a newly described genus, along with another new afrotropical species (*H. pobeguini*), without the designation of a type species. As the name suggests, grounds for the genus rested heavily on the possession of a single pterostigmal crossvein in the wings. A small illustration of the fore-wing of *H. chevalieri*, showing details of the venation, was provided.

Navás (1909: 529) – Recorded *H. chevalieri* from Obok (= Obock – Djibouti). No details were supplied other than that the material had been collected by Dr Jousseaume in 1897.

Esben-Petersen (1913: 136, 139) – Considered *Haplodictyus* to be a synonym of *Bittacus*, recording that a specimen seen by him, and identified by Navás as *H. chevalieri*, had two pterostigmal crossveins. A left wing of a newly-recorded female specimen from 'Africa' was illustrated (the drawing showing two pterostigmal crossveins and a missing Scv), the only other specimen listed being a female from 'Obok' (that recorded by Navás 1909). A key for the separation of 10 African species, including *B. chevalieri*, was provided.

Banks (1913: 233) – Also declared *Haplodictyus* to be a synonym of *Bittacus*.

Esben-Petersen (1915: 237) – Included *B. chevalieri* in a list of African Mecoptera without making comment about the species.

Esben-Petersen (1921: 136–137) – Listed the two female specimens reported upon in his 1913 paper. A photograph of both the fore- and hind-wings of the specimen labelled 'Africa' was provided (showing two pterostigmal crossveins in the fore-wing and one in the hind). Although the 'Obok' female had been reported on by Navás a year after the species had been described, Esben-Petersen erroneously stated that it was one of Navás's types.

Navás (1921: 77) – Reported, as *Haplodictyus chevalieri*, the first male specimen when he listed one from Senegal (between Matam and Bahel along the Senegal River) and briefly described the genitalia.

Lestage (1929: 3–4, 17) – Discussed discrepancies in published information about *B. chevalieri*, especially concerning details relating to wing venation, without examining any of the relevant material himself. He stated that Berland (Paris Museum), who provided information about the Navás type, had identified the specimen as a male. He expressed doubt that the Djibouti material, reported by Esben-Petersen, had been correctly identified. A key to 25 African *Bittacus* was presented in which *B. chevalieri* was separated into two distinct species based on venational differences – the species as portrayed by Esben-Petersen not, however, being given another name.

Fraser (1953 *not seen*) – Provided a new record of the species from Mali; a single female from 'Dogo' (cited by Byers 1971).

Byers (1971: 402–3) – Reviewed the species in his illustrated, annotated catalogue of African Mecoptera, providing the first illustrations of the male terminalia (from Mali). Previous records are discussed and observations made concerning the holotype, which he studied and found to be a female (not a male as stated by Lestage). A new record from Senegal (one male from Linguère) was provided. Doubt was expressed that Navás's recorded material from Djibouti (formerly French Somaliland) and the material merely labelled 'Africa' illustrated by Esben-Petersen had been correctly identified. Similarities with *B. aequalis* Navás and *B. pogeguini* (Navás) were briefly discussed.

Londt (1994: 49) – Listed *B. chevalieri* in a catalogue of afrotropical Mecoptera giving references and an indication of distribution.

At the commencement of this study there were, according to the literature, only seven known specimens of *B. chevalieri* (see list below), and doubt had been expressed about the correct identification of at least two of these. With the accumulation of good numbers (39) of previously unrecorded specimens, mainly from Mali and Socotra, a much better understanding of the species is now made possible.

MATERIAL AND METHODS

Institutions providing material or data, or housing specimens mentioned in this study, are listed below, together with the abbreviations used in the text, and the names of people who assisted, where relevant.

BMNH	The Natural History Museum, London
HLMD	Hessisches Landesmuseum Darmstadt, Darmstadt, Germany (Hans Pohl)
MNHN	Museum National D'Histoire Naturelle, Paris, France (Jeanne Charbonnel)
MRAC	Musee Royal de l'Afrique Centrale, Tervuren, Belgium (Jos Debecker)
NHMW	Naturhistorisches Museum Wien, Wien, Austria (Ulrike Aspöck)
NMSA	Natal Museum, Pietermaritzburg, South Africa

NMWC	National Museum of Wales, Cardiff, Wales, U.K. (John Deeming)
SEMC	Snow Entomological Museum, Kansas University, Lawrence, Kansas, USA (George Byers)

Specimens were either pinned or preserved in ethanol (70%). All the new specimens from Mali and Socotra were preserved in ethanol, but a number were subsequently transferred to pins. Specimens pinned from ethanol were not always easy to study (i.e. the Mali material) as wings tend to curl and fold on themselves unless carefully spread during the drying process (i.e. the Socotra material), making precise measurement particularly difficult.

Illustrations of genitalia were prepared after the removal and maceration of terminalia in hot potassium hydroxide. This technique allows sclerites to be extended to reveal as much detail as possible. Terminalia so treated were stored in a glycerine/ethanol mixture and placed in genitalia vials attached to the pins of the specimens concerned.

Standard abbreviations used in this text are as follows: A_1 – First Anal vein, Av – Apical crossvein, Cuv – Cubital crossvein, FM – First fork of the Media, FRs – First fork of the Radial Sector, FW – Fore-wing, HW – Hind-wing, Pcv – Pterostigmal crossveins, S – Sternum, Scv – Subcostal crossvein, T – Tergum.

TAXONOMY

Bittacus chevalieri (Navás, 1908)

(Figs 1–10)

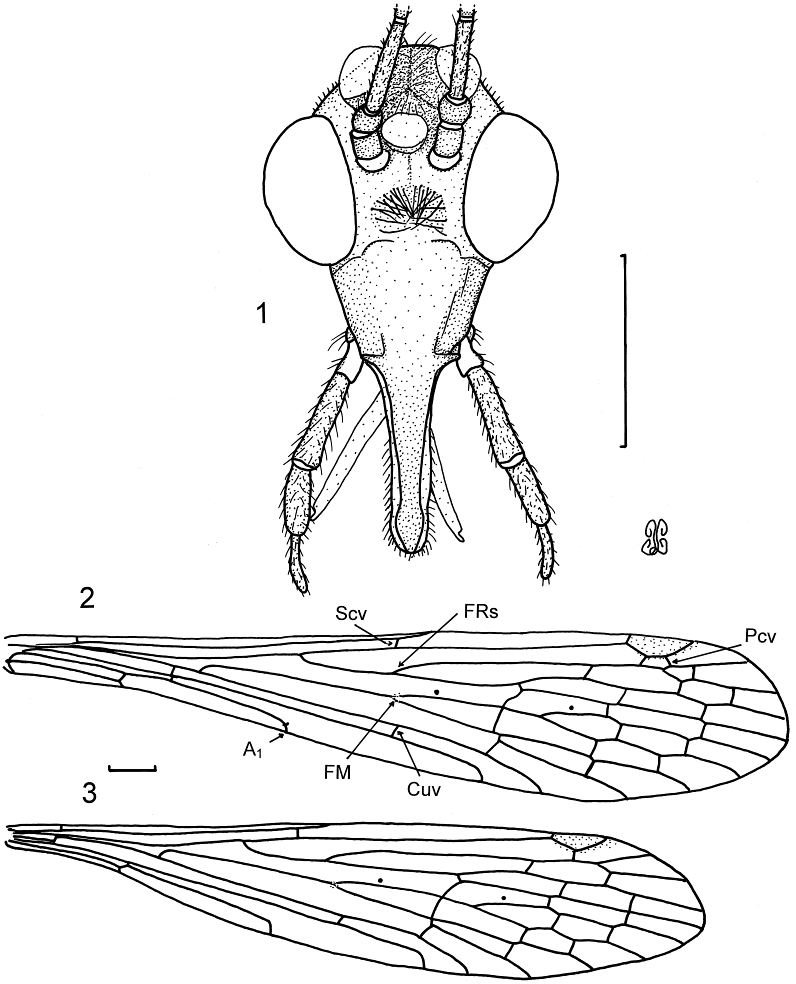
Haplodictyus chevalieri Navás, 1908: 16, Navás, 1909: 529.
Bittacus chevalieri; Esben-Petersen, 1913: 139, 1915: 237, 1921: 136–137; Navás, 1921: 77; Lestage, 1929: 3–4; Fraser, 1953: ?; Byers, 1971: 402–3; Londt, 1994: 49.
Bittacus nodosus Rust & Byers, 1976: 32–34. **Syn. n.**

Redescription: Based primarily on pinned and alcohol-preserved material from Mali and Socotra in NMSA. Sexes similar unless otherwise stated.

Head (Fig. 1): Brown-yellow, ocelli enclosed within a dark red-brown circular area. Ocelli large, dorsal pair larger than single median ocellus. Face between eyes with a shallow depression surrounded by inwardly directed setae. Antennal scape and pedicel brown-yellow, flagellum brown.

Thorax: Uniform brown-yellow (i.e. no obvious dark red-brown markings), pro- and mesonota slightly darker than other sclerites. All macrosetae black. Legs: Brown-yellow; distal tips of femora, tibiae and tarsomeres dark red-brown. Wings (Figs 2–3): FW 16.5 mm, HW 14.9 mm (average of 5♂5♀ from Socotra, measured from humeral crossvein to wing tip, ♀ on average only slightly smaller than ♂); venation dark brown, some distal crossveins weakly demarcated (i.e. poorly sclerotised); membrane uniformly covered with fine microtrichia, giving wings a slight pale brownish appearance. Pterostigma only slightly darker than other parts of membrane. Main features of venation as follows:

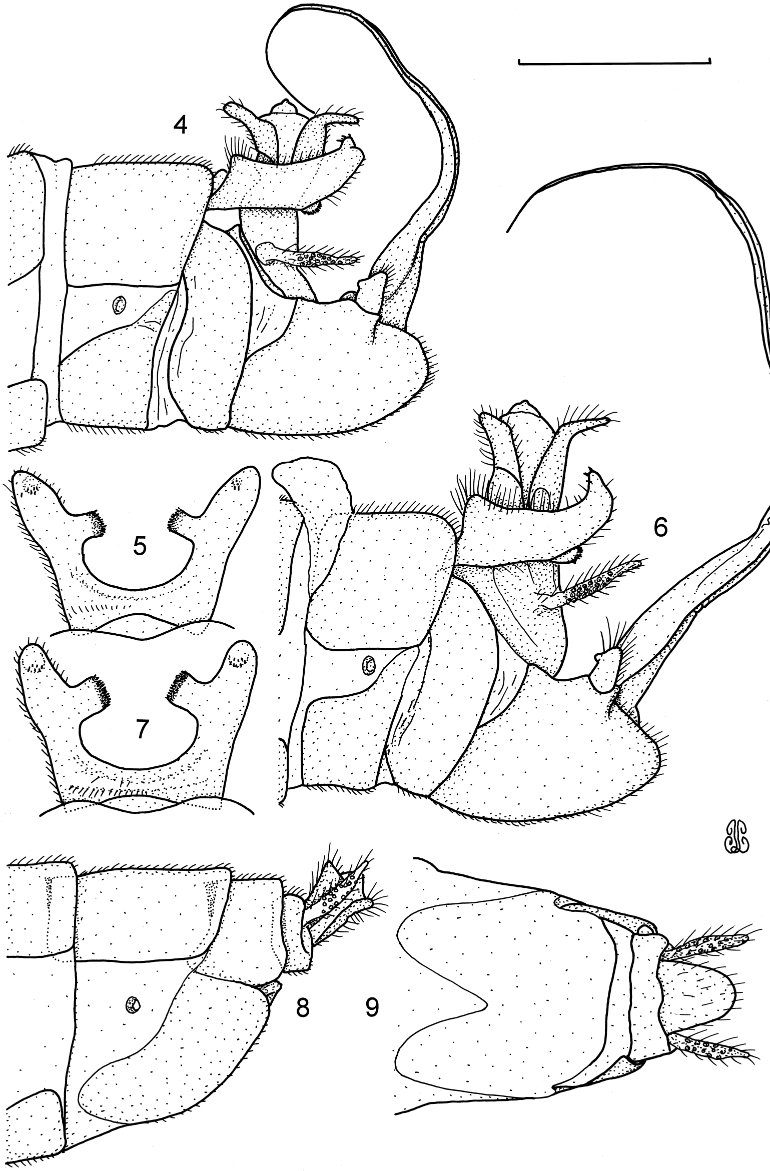
- Pcv variable in number (1 or 2) even in a single specimen. In a sample of 5♂5♀ from Socotra there are 2 Pcvs in 95% of FWs and 50% of HWs (the more common condition therefore being 2 Pcv).
- Scv, FRs, FM and Cuv almost in line in FW, Scv position being variable from a little beyond an imaginary line drawn through FRs and FM to a little before.



Figs 1–3. *Bittacus chevalieri* (Navás, 1908). 1. Head, anterior aspect. 2. Fore-wing. 3. Hind-wing. Scale lines = 1 mm, all material from Socotra (NMSA). Abbreviations: A$_1$ – First Anal vein, Cuv – Cubital crossvein, FM – First fork of the Media, FRs – First fork of the Radial Sector, Pcv – Pterostigmal crossveins, Scv – Subcostal crossvein.

- FRs, FM and Cuv almost in line in HW, Scv position variable, but always somewhat behind an imaginary line drawn through FRs and FM.
- A$_1$ short, reaching wing margin about halfway between distal tips of Cu$_2$ and A$_2$.
- Av absent in all specimens studied (possibly a consequence of having a short A$_1$). A few specimens possess a small ‘spur vein’ at distal end of A$_1$ (Fig. 2) which may represent the remnants of an Av.

Abdomen: Pale brownish yellow; proximal terga slightly paler than other sclerites. T3–8 with narrow dark red-brown posterior margin (seen in cleared specimens only). Sterna, especially S2–5, darker yellow-brown when compared to corresponding terga. Genitalia: Similar in colour to preceding segments. ♂ (Figs 4–7) with distal parts of aedeagus brown. A few alcohol-preserved males have pheromone glands protruding from between



Figs 4–9. *Bittacus chevalieri* (Navás, 1908), genitalia. 4–5. Male from Socotra. 6–7. Male from Mali (Mourdiah). 8–9. Female from Socotra. Scale lines = 1 mm, all material in NMSA.

T6–7 and T7–8. ♀ (Figs 8–9) with poorly defined (i.e. weakly sclerotised) subgenital plate.

Variation: Material studied suggests a species of remarkably uniform appearance across its range. The slight variation shown between males (especially in the shape of the epandrium) from Socotra and Mali appears to be consistent geographical variation as all males from these places have a generally similar appearance.

Previously recorded material: *Afrotropical*: CHAD: 1♀ holotype, Afrique Central, Kanem [Region of Chad – 15°00'N:16°00'E], A. Chevalier, 1904 (MNHN). DJIBOUTI: 1♀, Obok [= Obock – 11°57'47"N:43°17'26"E], Jousseaune (MNHN). MALI: 1♀, Dogo [? = Macina – 13°39'N:05°20'W] (repository not known); 1♂1?, Nioro [15°14'N:09°35'W], Soudan, F. de Zelther ix.1909, (MNHN). SENEGAL: 1♂, Matam [15°40'N:13°15'W] and Bahel [?], Dialla [?], G. Malou, 1908 29.ix.1907 (MNHN); 1♂, Linguère [15°24'N:15°07'W], A. Descarpentries, T. Leye & A. Villiers, Mission IFAN – Museum, ix.1967 (MNHN). UNKNOWN: 1♀, Africa (NHMW). *Oriental*: INDIA: 1♂1? paratypes (*nodosus*), Deesa [24°15'N:72°10'E], 8.i.1935, G. G. Nurse (BMNH). PAKISTAN: 1♂ holotype (*nodosus*), Karachi [24°52'N:67°03'E], 8.x.1959, R. I. Sailer (SEMC).

New records: CHAD: 1♂, N'Gouri [13°38'N:15°22'E], Dist. de Kanem, P. Renaud, viii.1958 (MRAC); MALI: 14♂2♀ 1?, Mourdiah [14°28'N:07°28'W], M. Matthews, 13–25.viii, 19–25.ix, 3–12.x.1986 (NMWC, NMSA); YEMEN: 10♂11♀, Socotra Archipelago, Socotra, Diksam Mtn. [12°31.40'N:53°57.20'E], H. Pohl, 26–27.x.2000 (HLMD, NMSA).

Synonymy of *B. nodosus*: Using the excellent description and illustrations published by Rust & Byers (1976), it is my opinion that *B. nodosus* is a synonym of *B. chevalieri*. Rust & Byers (1976) recognised that 'the male genitalia of *nodosus* closely resemble those of *B. chevalieri* … especially in the epiandrial lobes', but noted that '*B. nodosus* differs … in having a short, spined, dorsal protuberance at the apex of each epiandrial lobe' and that 'the posterior margins of the basistyles are abruptly truncate, not rounded'.. While the dorsal protuberance at the apex of the epandrial lobe is slightly different in development when compared with West African males of *B. chevalieri* (Fig. 6), the condition illustrated by Rust & Byers (1976) appears identical to that seen in males from Socotra (Fig. 4). As far as the posterior margin of the basistyles is concerned, Rust & Byers's Fig. 9 does demonstrate a somewhat more truncated condition when compared with both the West African and Socotran material. However, the Rust & Byers illustrations appear to have been made from a dry specimen (i.e. not macerated in warm KOH) as details of segment 10 and associated structures (e.g. proctiger) are not illustrated – presumably because they were contracted between surrounding sclerites (as is commonly the condition in dry mounted material). This being true, I suggest that the more rounded appearance of the basistyles of West African and Socotran males may well be largely due to the softening of these structures during maceration. Even if this is not the case, a degree of variation can be anticipated in populations so widely separated (as is evident between the West African and Socotran populations), and so I am confident that future collecting will demonstrate clinal variation and support the contention that *nodosus* and *chevalieri* are indeed conspecific.

Validity of previous African records: Male specimens pose no identification problems as the genitalia are quite characteristic. Byers (1971) was satisfied that all previously recorded females were conspecific, with possible exceptions being the female labelled 'Africa' reported by Esben-Petersen, because the venation demonstrated slight differences when compared with other specimens, and the female from Djibouti, because the locality was so far removed from Chad and the West African localities. With the discovery of the Socotra specimens, I am prepared to accept that the Djibouti record is probably correct and, with the now documented variation in venation, I am satisfied that the wings illustrated by Esben-Petersen (1921) do represent *B. chevalieri*. While additional material would assist in supporting these views, I accept all the material listed in this paper as being correctly identified.

Notes on previous illustrations: Three authors published illustrations of one or both wings, and Byers (1971) illustrated the male genitalia of *B. chevalieri*. Most of these illustrations are defective in one or other respect. Navás's (1908) drawing of a single fore-wing shows most of the essential characters of the species, but is defective in that no Scv or Cuv is shown, and the wing tip has a somewhat pointed appearance. All the wings I have studied have Scv and Cuv present and have rather more rounded apices. Esben-Petersen's (1921) photograph of both fore- and hind-wing is good and shows that the drawing he published in 1913, of the same specimen, was defective in that the Scv was omitted. Byers's (1971) drawings of the male terminalia are generally accurate, although no details of segment 10 and its associated structures are given, apart from a gonostylus which has its base hidden by S9. These drawings were probably made without first removing and macerating the terminalia.

Closely related species: Byers (1971) briefly noted that *B. chevalieri* is similar to both *B. aequalis* Navás, 1914 and *B. pobeguini* (Navás, 1908). The male genitalia of both these species are, however, quite different from *B. chevalieri* (see Byers (1971) and Londt (1972)). Rust & Byers (1976) draw attention to similarities between their *B. nodosus* and *B. latipennis* Gerstaecker, 1885 and *B. henryi* Kimmins, 1928. *B. latipennis* is clearly different in a number of respects, but *B. henryi* is very similar and is probably the closest relative of *B. chevalieri*.. All these species can, however, be readily distinguished on male genital characteristics.

Distribution: The distribution of *B. chevalieri* is depicted in Fig. 10. The eleven known localities all fall within about 14 degrees of latitude (from *ca.* 11–25°N), a narrow zone when compared to the very extensive range in longitude of some 85 degrees (from *ca.* 13°W–72°E). With a distance of about 9000 km between its Senegal and Indian populations, this species has what must be the most extensive distribution of any

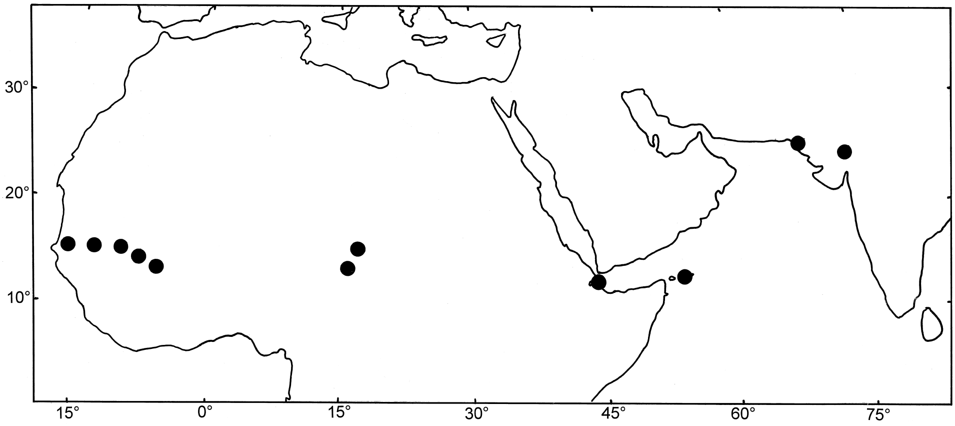


Fig. 10. *Bittacus chevalieri* (Navás, 1908), distribution.

mecopteran. It is particularly interesting that all the known localities fall within two or three major natural vegetation categories (depending on the maps you use) dominated by grass; namely 'Savanna' (Grass and Scrub), 'Steppe' (Short Grass) and 'Desert Vegetation' (Xerophytic Shrub, Grass and Cactus) (terminology that of *The Times Atlas of the World* – Comprehensive Edition 1988). It can be anticipated that any species adapted for existence in grassland is likely to be very widely distributed. Maps suggest that the Indian population of *B. chevalieri* coincides with the eastern limits of the grassland biome at that latitude, and so it is not anticipated that future collecting will extend the distribution very much further.

Phenology: Except for the Indian material, collected in January, all other samples were collected during August, September and October – a period corresponding to the northern hemisphere's late summer and autumn, when the development of grasses is probably at its peak.

ACKNOWLEDGEMENTS

Dr Hans Pohl and Dr John Deeming are thanked for sending me material from Socotra and Mali for study, and for donating some of their material to the Natal Museum. Dr George Byers kindly sent me copies of a few papers which had not been available to me and drew my attention to the close similarity between *B. nodosus* and *B. chevalieri*. My colleagues, Dr David Barraclough and Dr Brian Stuckenberg offered useful comments on the manuscript.

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